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Determinants of Interest Rate Spreads In Uganda's Commercial Banking Sector: A Panel Data Analysis

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Abstract

Uganda's interest rate spreads have persistently remained high despite the financial liberalisation undertaken in the 1990s. Using data for 24 banks, we assess the determinants of interest rate spreads in Uganda's commercial banking sector for the period 2005-2015. Results show that, among the bank-specific factors, interest rate spreads increase with increase in credit risk, liquidity risk, and capital adequacy ratio. Contrary to most studies and a priori expectations, non-interest income is shown to be positively related to bank spreads. Bank size is shown to be negatively related to interest rate spreads. For industry-specific factors, foreign bank participation in loans markets is associated with higher spreads. For macroeconomic factors, high inflation rates are shown to translate into high spreads, whilst high real GDP growth rates and broad money supply are associated with lower spreads. Contrary to theory and most literature, exchange rate volatility is associated with lower bank spreads. Going forward, banks and government should devise mechanisms to encourage loan repayment, and banks should be encouraged to reduce on holding excess liquid assets. At a macro-level, the Bank of Uganda should maintain its stance on curbing inflation. Economic growth and financial development should as well be encouraged.

Keywords: *interest rate spreads; dynamic panel; Uganda's commercial banking sector*

JEL Classifications: *C23; E43; E44; G21; L11*

1. Introduction

Proponents of financial market liberalisation argue that the removal of financial market restrictions reduces the cost of financial intermediation.[1] Consequently, reduction in the cost of intermediation translates into increased credit supply and demand, thus fostering financial development and economic growth (Beck & Hesse, 2009; Claessens et al., 2001; Crowley, 2007). This argument is premised on the understanding that financial liberalisation—which is often characterised by an increase in the number of financial institutions—enhances competition and financial deepening, leading to lower interest rate spreads, and thus efficiency in the financial sector.

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[1]The cost of financial intermediation is often proxied by interest rate spreads—the difference between the interest rate charged to borrowers and the rate paid to depositors.

Considering the above, Uganda embarked on financial market liberalisation in the early 1990s to stimulate competition and enhance efficiency in financial markets. The liberalisation of financial markets was effected through a number of reforms, including the easing of financial markets entry requirements; privatisation of the Uganda Commercial Bank (UCB)—the largest and government-owned commercial bank—in 2002; liberalisation of interest rates; removal of credit ceilings and direct credit facilities towards crop finance; removal of restrictions on dealing in foreign exchange and treasury bills; and the introduction of shilling interbank money market and the rediscount facility (Beck & Hesse, 2009; Mugume et al., 2009; Nampewo, 2013). The reforms have undoubtedly made Uganda's financial sector one of the most liberalised financial sectors in Sub-Saharan Africa (SSA).

However, interest rate spreads have remained high in Uganda's banking sector relative to regional and global averages despite the liberalisation of financial markets. Between 2005 and 2015, Uganda's interest rate spreads averaged 10.4% compared to averages of 8.5%, 7.4%, and 8.6% in the other East African Community (EAC) countries of Kenya, Tanzania, and Rwanda, respectively.[2] Furthermore, the average interest rate spreads were higher than average spreads of 7.5% in SSA, 8.1% in low-income countries, and 5.7% world average during the same period. Similarly, Uganda's net interest margins—banks' net interest revenue as a ratio of total interest earning assets—have consistently been higher than regional and global averages (see Table 1).[3]

Table 1: Financial Intermediation Across Countries (% Average 2005-2015)[4]

	Interest Rate Spread	Net Interest Margin	Bank Deposits/GDP	Private Sector Credit/GDP
Uganda	10.4%	10.4%	14.3%	10.4%
Kenya	8.5%	8.2%	37.1%	29.4%
Tanzania	7.4%	7.6%	17.6%	10.8%
Rwanda	8.6%	9.7%	13.6%	13.5%
Burundi	–	8.1%	18.3%	15.5%
SSA	7.5%	6.9%	–	54.0%
Low Income Country	8.1%	6.0%	–	15.5%
World Average	5.7%	–	–	123.8%

Source: Data are from the June 2017 Updated Version of Financial Development and Structure dataset of Demirguc-Kunt et al. (2017).

[2] Data on interest rate spreads for Burundi and South Sudan is not available

[3] Net interest margins are an ex-post definition of interest rate spreads

[4] Interest rate spread is the difference between the lending rate and the deposit rate. Net interest margin is the net interest revenue relative to total earning assets. Bank deposits/GDP is total deposits in deposit money banks as share of GDP. Private credit/GDP is total claims of financial institutions on the domestic private non-financial sector as share of GDP.

Interest rate spreads are of concern to policymakers because they are a reflection of the cost of financial intermediation. High interest rate spreads point to a low level of efficiency and a lack of competitiveness in the financial sector, which adversely affect savings and investment, and thus undermine economic growth levels (Almarzoqi & Naceur, 2015; Folawewo & Tennant, 2008; Mugume et al., 2009). A financial sector with high interest rate spreads is usually characterised by low deposit rates and/or high lending rates. Low deposit rates discourage deposits, hence limiting resources available to finance bank credit; while high lending rates discourage borrowing, especially for long-term investment. This could partly explain Uganda's low bank deposit to GDP ratio, and private sector credit to GDP ratio relative to the other EAC countries (see Table 1). Relatedly, high interest rate spreads often lead to channelling of deposits into less productive investments in the economy (Crowley, 2007). Due to adverse selection and moral hazard, high lending rates attract high risk borrowers, which in turn exacerbates credit risk in the banking sector (Stiglitz & Weiss, 1981).

There has been broad voicing of concerns about high interest rate spreads in both public and policy fora. Some sections of the public have called for government regulation of both deposit and lending rates. Such calls have been influenced by the enactment of an Act of parliament by Kenya—the Banking (Amendment) Act, 2016—to regulate interest rate spreads in Kenya's banking sector. However, there is thin empirical literature on the determinants of interest rate spreads in Uganda to guide policy direction. Available studies use either time series data analysis (Nampewo, 2013), or static panel data analysis (Beck & Hesse, 2009; Mugume et al., 2009; Nannyonjo, 2001).

Studies that use time series data analysis—though accounting for variation of interest rate spreads over time—do not account for variation of interest rate spreads across banks, whilst studies that use static panel data analysis—though accounting for variation of interest rate spreads over time and across bank—do not account for the impact of interest rate spreads of previous periods on current spreads. Yet empirical evidence has shown that interest rate spreads significantly vary across banks, and depend on spreads in previous periods (Carbo & Rodriguez, 2007; Folawewo & Tennant, 2008). It is against such a background that the current study examines determinants of interest rate spreads in Uganda's commercial banking sector using dynamic panel estimation techniques and the most recent data. The use of dynamic panel estimation techniques is intended to capture the impact of interest rate spreads in the previous periods on the current spreads. By doing something new, the results of this study could invaluably benefit policymakers, more so in the face of the current critical debate of regulated versus liberalised interest rates.

The study covers 24 commercial banks licensed and regulated by the Bank of Uganda, the central bank of Uganda, as of 2015 for the period 2005−2015.[5] New

[5] See Appendix A1 for the list of commercial banks

banks that were licensed during the study period are included in the study, whilst banks that exited the industry are excluded. The inclusion of only commercial banks in the study does not negate the fact that Uganda's formal banking system is composed of other financial institutions. In fact, the system contains commercial banks (Tier 1), credit institutions (Tier 2), and microfinance deposit-taking institutions (MDIs) (Tier 3). However, banks still play a dominant role in financial intermediation. On the other hand, Tier 2 institutions are specialised financial institutions whose interest rate spreads might not be comparable to those of banks (Beck & Hesse, 2009). Furthermore, the role of MDIs is negligible in financial intermediation.

The remaining part of the paper is organised as follows. Section 2 discusses the related literature on interest rate spreads. Section 3 details the methodology used in the paper. Section 4 gives the results of the study, while section 5 gives conclusions and policy implications of the study.

2. Literature Review

2.1 Theoretical Literature

There is an ample theoretical literature that explain sources of interest spreads and margins. This literature traces the sources of high interest spreads and margins to risks and uncertainties, market and banks' characteristics, banks' capital structure, macroeconomic environment, and regulation. Selected theoretical literature for the study include the risk-based hypothesis, efficiency hypothesis, market structure view, macroeconomic view, and the capital structure hypothesis.

The risk-based hypothesis considers risks lenders take and the compensation for these risks as part of interest rate spread. Such risks are largely attributed to the asymmetric nature of information in financial markets. Thus, interest rate spreads compensate risks resulting from information asymmetry, and the resulting inability of lenders to perfectly ascertain the creditworthiness of a borrower and his/her project ex-ante, and subsequently monitor the implementation ex-post (Crowley, 2007). This gives rise to adverse selection and moral hazard (Stiglitz & Weiss, 1981). In turn, information asymmetry increases credit and liquidity risks faced by financial institutions, thus leading to an increase in lending rates. According to the risk-based view, other risks associated with higher spreads in the banking system include interest risks, exchange rate risks, and operational risks.

The efficiency hypothesis focuses on the fixed cost component of financial service provision, and the resulting scale economies. Processing an individual payment or savings transaction entails costs that are, in part, independent of the value of the transaction. Such costs relate to, among others, branch network operation costs, computer systems, and legal and accounting services (Beck & Hesse, 2009). According to this hypothesis, small financial systems are not able to exploit economies of scale and, therefore, face higher costs and interest rate spreads (Beck & Hesse, 2009; Demirguc-Kunt & Huizinga, 1999).

The market structure view focuses on the competitiveness and ownership structure of a banking sector. According to this theory, more competitive systems have more efficient banks with lower spreads, as well as deeper and broader banking markets. In addition, it also posits that foreign bank entry can also improve the efficiency of a banking system, and thus reduce interest rate spreads. However, foreign bank entry can also result into higher spreads and margins if accompanied by higher concentration and lower competitiveness (Demirguc-Kunt & Huizinga, 1999).

The macroeconomic view sees interest rate spreads as being driven by macroeconomic instability. Such macroeconomic parameters include, among others, inflation, exchange rates, treasury bill rates, level of financial sector development, and economic cycles. Inflation can affect spreads if monetary shocks are not passed through to the same extent to deposit and lending rates, or adjustment occurs at different speeds (Mugume et al., 2009). Changes in treasury bill rates proxies the volatility in money market. Higher treasury bill rates are often associated with higher bank spreads (Mugume et al., 2009; Nampewo, 2013). In addition, volatility in an exchange rate is an important determinant of bank spreads. Also, currency depreciation is generally associated with high bank spreads (Folawewo & Tennant, 2008). Similarly, real GDP growth rates are reported to affect lending rates as the creditworthiness of borrowers varies over a business cycle with periods of recessions being associated with higher default rates, and thus higher bank spreads (Demirguc-Kunt & Huizinga, 1999).

On its part, the capital structure hypothesis posits that the capital structure of a bank can contribute to its spreads and margins. According the hypothesis, the level of capital that a bank holds to cushion itself against risks can result into higher spreads (Saunders & Schumacher, 2000). In particular, holding capital in excess of the regulatory minimum for insuring against credit risk turns out to be relatively more expensive than debt because of differential taxation (Chirwa & Mlachila, 2004). Capital costs may be offset by raising banks spreads. Regulatory environment also tends to influence bank spreads. Higher reserve requirements can result into wider bank margins (Saunders & Schumacher, 2000).

2.2 Empirical Literature

Empirical literature that examines the determinants of interest rate spreads generally uses variables that are categorised into: (i) bank-specific factors—factors that affect individual banks and whose magnitude vary from bank to bank; (ii) banking industry-specific factors and regulations—factors that affect the entire banking sector; and (iii) macroeconomic variables—factors that affect the entire economy. As far as bank-specific factors are concerned, several factors—including among others, credit risk, liquidity risk, bank size, operating costs, return on assets, non-interest income, and capital adequacy ratio—have been reported in the literature as determinants of interest rate spreads. On one hand, higher credit risk, liquidity risk, cost of operation, return on assets, and capital adequacy ratios are associated with higher interest spreads. High credit risk drives up interest spreads

through its associated cost of loan-loss provisions resulting from loan defaults (Ahokpossi, 2013; Mugume et al., 2009). High liquidity risks (low liquidity ratios) reduce funds available to banks for lending, which leads to high spreads due to excess demand for loans. Banks usually maintain high liquidity ratios to safeguard against sudden withdrawal demands by customers, which often translates into higher ex-ante spreads (Islam & Nishiyama, 2016; Mannasoo, 2012).

Furthermore, higher costs of operations are often covered by banks through payment of low interest rates on deposits and/or charging of high lending rates on loans, which culminates into higher spreads (Almarzoqi & Naceur, 2015; Beck & Hesse, 2009; Siddiqui, 2012). Costs of operations in the banking sector relate to screening and monitoring borrowers, and processing savings and payment services, which are partly covered through high spreads. Additionally, interest rate spreads are an increasing function of banks' returns on assets because high returns on assets are associated with high bank spreads. This is the case in most developing countries where interest income accounts for much of bank profits due to limited diversification of banking activities (Beck & Hesse, 2009; Were & Wambua, 2014). Lastly, a high capital adequacy ratio is associated with high bank spreads due to risk aversion. Under the assumption of risk aversion, shareholders usually demand higher returns on their additional equity (Ahokpossi, 2013; Crowley, 2007).

On the other hand, a big bank size and higher levels of non-interest income are associated with lower interest rate spreads. On bank size, smaller banks tend to charge higher margins than bigger banks. In addition, banks with greater market shares offer lower lending rates, whilst banks with smaller market shares offer higher lending rates (Beck & Hesse, 2009; Willmott, 2012). As far as non-interest income is concerned, higher levels of non-interest income are associated with lower interest spreads. Banks that rely heavily on revenue from non-traditional business have lower interest margins given that such non-interest income somewhat compensates for the lower margins from traditional bank activities (Almarzoqi & Naceur, 2015; Carbo & Rodriguez, 2007; Mujeri & Younus, 2009).

For industry-specific factors, bank concentration, market structure, and bank regulation are some of the factors that have been reported in empirical literature as determinants of bank interest spreads. High market concentration translates into high interest spreads. This is often due to the collusive behaviour associated with high market concentration (Ahokpossi, 2013; Almarzoqi & Naceur, 2015; Demirguc-Kunt & Huizinga, 1999; Jamaludin et al., 2015). On market structure, foreign bank ownership is found to have a positive relationship with bank spreads (Beck & Hesse, 2009; Crowley, 2007). The association of foreign banks, especially in developing countries, with high spreads could partly be attributed to the limited competition they often face in these countries. However, on the contrary, Ahokpossi (2013) shows that foreign bank ownership leads to lower interest margins. Generally, foreign bank market share is associated with lower bank spreads and margins in developed countries, but higher spreads and margins in developing countries (Demirguc-Kunt & Huizinga, 1999).

Finally, according to the literature, macroeconomic variables that affect interest spreads include, among others, inflation, real GDP growth rate, treasury bill rates, exchange rate volatility, and broad money supply to GDP (M2/GDP). On one hand, high levels of inflation, Treasury bill rates, and exchange rate volatility are associated with high interest rate spreads. Inflation leads to decrease in real interest rates, and as such banks tend to set wide spreads to compensate for losses (Ahokpossi, 2013; Almarzoqi & Naceur, 2015; Beck & Hesse, 2009). High treasury bill rates are an incentive to banks to invest more of their deposits in risk free government instruments compared to loans, which are characterised by high credit risk. This translates into high bank spreads in the banking sector because of the reduced supply of credit (Beck & Hesse, 2009; Nampewo, 2013). Also, uncertainty in the foreign exchange market affects the profitability of banks, especially for foreign owned banks (Folawewo & Tennant, 2008; Mugume et al., 2009).

On the other hand, high economic growth rates and broad money supply (M2/GDP) are associated with lower interest spreads. A slowdown in economic growth puts an upward pressure on bank spreads, especially through its impact on banks' profitability. Asset quality deteriorates with an increase in default rate, which is more prevalent in situations of economic slowdown. Furthermore, slow growth is characterised with low savings in an economy, which constrains the mobilisation of investible resources by banks, hence leading to wide spreads (Islam & Nishiyama, 2016; Mugume et al., 2009). Broad money supply (M2/GDP) is an indicator of financial sector development. As such, M2/GDP growth leads to lower interest spreads, especially in developing countries like Uganda where financial markets are not well-developed.

In summary, there are several empirical studies on the determinants of interest rate spreads focusing on different sets of factors (bank-specific, industry-related, and/or macroeconomic factors). However, most studies note that spreads and margins are significantly affected by bank-specific factors than any other category of factors. Nonetheless, for an in-depth understanding of factors that influence spreads, there is always need to focus on all the three categories of factors during empirical analysis. As far as the research gap is concerned, studies on the determinants of interest rate spreads in Uganda, as aforementioned, do not consider the impact of interest rate spreads in the previous periods on current spreads. Also, the studies do not use recent data although the banking sector has seen several new developments. To that effect, this study seeks to close these research gaps.

3. Methodology

3.1 Theoretical Framework

Theoretical frameworks that are often used to assess the determinants of interest rate spreads are based on banks' balance sheets (Demirguc-Kunt & Huzinga, 1999), or on banks' behavioural assumptions (Brock & Rojas-Suarez, 2000; Ho & Saunders, 1981; Saunders & Schumacher, 2000). In the Ugandan context, Mugume et al. (2009) analyse the determinants of interest rate spreads basing on the

behavioural assumptions of banking firms, whilst Nannyonjo (2001) specifically follows the Ho and Saunders (1981) bank dealership model. For the purposes of this study, we follow the Ho and Saunders (1981) bank dealership theoretical framework, and its later extensions by Maudos and Fernandez de Guevara (2004), given that it explains bank behaviour during an intermediation process.

Under this model, a bank is assumed to be risk-averse in its intermediation activities. A single planning period is assumed, and a bank sets interest rates at the start of the period before any deposits or loans are made. Such rates are kept constant for the entire planning period. However, due to asymmetric information, interest rates on loans (r_L) and deposits (r_D) are set optimally so as to guard against volatilities in the money market, which a bank has to resort to in case of excess loan demand or excess deposit supply. As result, interest rates are set as margins relative to the money market interest rate (r), that is:

$$r_D = r - a$$
$$r_L = r - b \qquad (1)$$

a and b are deposits and loans interest rate margins, respectively, relative to the money market interest rate. The unit margin or spread S is expressed as:

$$S = r_L - r_D = (a + b) \qquad (2)$$

If a new deposit is made in a bank without a corresponding new loan demand at the time, the bank temporarily invests the funds received in the money market at an interest rate r. This exposes the bank to a risk of reinvestment at the end of the period in case the money market interest rates plummet. Similarly, if a new loan demand is made before any new deposit, the bank obtains funds in the money market. This exposes the bank to a refinancing risk if interest rates rise. In addition, the return on loans is uncertain due to credit risk (possibility of default). Thus, the bank applies a margin to loans (b) and deposits (a) that compensates for both interest rate and credit risks.

The initial wealth of the bank is the difference between its assets (loans *(L)* and liabilities) deposits *(D)* plus net money market assets *(M)*:

$$W_0 = L_0 - D_0 + M_0 = I_0 + M_0 \qquad (3)$$

$L_0 - D_0$ is the net credit inventory (I_0)

The operating costs of a bank are a function of the deposits received ($C(D)$) and loans made ($C(L)$). As such, the cost of the net credit inventory is $C(I) = C(L) - C(D)$.

From the above, the final wealth of the bank is:

$$W_T = (1 + r_I + Z_I)I_0 + M_0(1 + r + Z_M) - C(I_0)$$
$$= I_0(1 + r_I) + M_0(1 + r) + I_0 Z_I + M_0 Z_M - C(I_0)$$

But $W_0 = I_0 + M_0$

$$W_T = W_0(1 + r_W) + I_0 Z_I + M_0 Z_M - C(I_0) \quad (4)$$

where:

$r_I = \frac{r_L L_0 - r_D D_0}{I_0}$ is the average return on net credit inventory;

$r_W = r_I \frac{I_0}{W_0} + r \frac{M_0}{W_0}$ is the return on the bank's initial wealth; and

$Z_I = Z_L \frac{L_0}{I_0} + Z_D \frac{D_0}{I_0} = Z_P \frac{L_0}{I_0}$ is the average credit risk of the net credit inventory.[6] Z_M and Z_L reflect the two forms of uncertainty faced by banks: interest rate risk, distributed as $Z_M \backsim N(0, \sigma_M^2)$; and credit risk, distributed as $Z_M \backsim N(0, \sigma_L^2)$.

Banks are assumed to maximise their expected utility. A bank's utility function is approximated using the Taylor expansion around the expected level of wealth ($\overline{W} = E(W)$).

$$EU(W) = U(\overline{W}) + U'(\overline{W})E(W - \overline{W}) + \frac{1}{2}U''(W)E(W - \overline{W})^2 \quad (5)$$

The utility function is assumed to be continuous and doubly differentiable with $U' > 0$ and $U'' < 0$, which makes a bank risk-averse.

When a new deposit *D,* attracting an interest r_D, is made and a bank does not issue (a) new loan(s), the deposit is invested in a money market at a return of $(r + Z_M)D$. Given that $W - \overline{W} = L_0 Z_L + M_0 Z_M$, and given operating costs $C(D)$ incurred in the receipt of deposits, substituting the new value of the final wealth in (5), the increase in expected utility associated with the new deposit will be:

$$\Delta EU(W_D) = EU(W_T) - EU(W)$$
$$= U'(\overline{W})[aD - C(D)] + \frac{1}{2}U''(\overline{W})\left[\begin{matrix}(aD - C(D))^2 + (D + 2M_0)D\sigma_M^2 \\ +2\,L_0 D\sigma_{LM}\end{matrix}\right] \quad (6)$$

Similarly, if a new loan request is made at a cost of production $C(L)$, the increase in expected utility would be:

$$\Delta EU(W_L) = EU(W_T) - EU(W)$$
$$= U'(\overline{W})[aL - (L)]\frac{1}{2}U''(\overline{W})\left[\begin{matrix}(aL - C(L))^2 + (L + 2L_0)L\sigma_L^2 + (L - 2M_0)L\sigma_M^2 \\ +2(M_0 - L_0 - L)L\sigma_{LM}\end{matrix}\right] \quad (7)$$

Assuming that credits and deposits are made randomly according to a Poisson distribution, the probability of granting a credit or receiving a deposit is a decreasing function of the margins applied by the bank:

[6]It is assumed that the deposits are an activity that is not subject to any kind of risks. Hence, $Z_D = 0$.

$$Pr_D = \alpha_D - \beta_D a$$
$$Pr_L = \alpha_L - \beta_L b \qquad (8)$$

The maximisation problem is therefore as follows:

$$Max_{a,b} EU(\Delta W) = (\alpha_D - \beta_D a)\Delta EU(W_D) + (\alpha_L - \beta_L b)\Delta EU(W_l) \qquad (9)$$

The first order conditions with respect to a and b are given as:

$$a = \frac{1}{2}\frac{\alpha_D}{\beta_D} + \frac{C(D)}{D} - \frac{1}{4}\frac{U''(\overline{W})}{U'(\overline{W})}[(D + 2M_0)\sigma_M^2 + 2\,L_0\sigma_{LM}]$$

$$b = \frac{1}{2}\frac{\alpha_L}{\beta_L} + \frac{1}{2}\frac{C(L)}{L} - \frac{1}{4}\frac{U''(\overline{W})}{U'(\overline{W})}\begin{bmatrix}(L + 2L_0)\sigma_L^2 + (L - 2M_0)\sigma_M^2 + 2(M_0 - \\ L_0 - L)\sigma_{LM}\end{bmatrix} \qquad (10)$$

So, the optimal interest margin S is:

$$S = a + b = \frac{1}{2}\left(\frac{\alpha_D}{\beta_D} + \frac{\alpha_L}{\beta_L}\right) + \frac{1}{2}\left(\frac{C(L)}{L} + \frac{C(D)}{D}\right) - \frac{1}{4}\frac{U''(\overline{W})}{U'(\overline{W})} - \frac{1}{4}\frac{U''(\overline{W})}{U'(\overline{W})}[(L + 2L_0)\sigma_L^2 + (L + D)\sigma_M^2 + 2(M_0 - L)]\sigma_{LM} \qquad (11)$$

From (11), the determinants of interest rate spreads are:

(a) Market structure competitiveness, which is determined by the elasticity of loan demand and deposit supply (β). Less elastic credit demand (or deposit supply) is associated with a less value of β, which enables a bank to apply high margins due to higher monopoly power.

(b) Operating costs – *C(D)* and *C(L).* Higher operating costs are associated with higher margins.

(c) Risk aversion, which is shown by the coefficient of absolute risk aversion – $U''(W)/U'(W)$. If a bank is risk-averse, then $U''(W) < 0$; then $[U''(W)/U'(W)] > 0$. More risk-averse banks often charge higher margins.

(d) Money market interest rate volatility (σ_M^2). A higher money market interest rate volatility is associated with greater market risk, and as such, higher margins are often applied as a bank's risk premium.

(e) Credit risk (σ_L^2). Greater uncertainty of expected return on loans granted (default risk) is associated with higher spreads.

(f) Covariance between interest rate risk and credit risk, σ_{LM}. This measures the level of diversification of a bank's income since interest rate risk and credit risk are negatively correlated. We use non-interest income to measure the level of the diversification of revenue.

(g) Average size of credit ($L + 2L_0$) and deposit ($L + \mathrm{D}$). The unit margins increase with an increase in the average size of operations (deposits and loans).

In addition to the variables in the theoretical framework, empirical literature shows capital adequacy ratio as one of the bank-specific determinants of interest rate spreads. As such, the study includes it in the empirical model specification. In addition, empirical literature also includes macroeconomic factors given their impact on interest rate spreads. These factors, among others, include inflation rate, real GDP growth rate, exchange rate volatility, and M2/GDP (Beck & Hesse, 2009; Folawewo & Tennant, 2008; Nannyonjo, 2001).

3.2 Empirical Model Specification

To empirically estimate the marginal impact of the determinants of interest rate spreads, we model interest rate spreads as a linear function of bank-specific characteristics, banking industry-specific variables, and macroeconomic conditions. As in Beck and Hesse (2009), Maudos and Solis (2009), Mugume et al. (2009), Rebei (2014), and Were and Wambua (2014), etc., the interest rate spreads function is given as:

$$IRS_{it} = f\left(X_{it}^{j}, X_{t}^{k}, X_{t}^{l}, u_{\mathrm{it}}\right) \tag{12}$$

where IRS_{it} is the interest rate spread of bank i in period t, X_{it}^{j} denotes bank-specific variables, X_{t}^{k} denotes bank industry-specific variables, X_{t}^{l} denotes the macroeconomic factors, and u_{it} is the disturbance term.

We use a dynamic panel model to estimate the marginal impact of the determinants of interest rate spread. This is because interest rate spreads have dynamic relationships with their determinants (Folawewo & Tennant, 2008; Maudos & Solis, 2009). Under dynamic panel estimation, the lagged dependent variable (interest rate spreads in period $t-1$) is included among the regressors. Thus, the dynamic panel estimation equation is specified as follows:

$$IRS_{it} = \alpha + \delta IRS_{it-1} + \sum_{j=1}^{7} \beta_j X_{it}^{j} + \sum_{k=1}^{2} \eta_k X_{t}^{k} + \sum_{l=1}^{5} \phi_l X_{t}^{l} + u_{it} \tag{13}$$

$$u_{it} = \mu_i + \lambda_t + v_{it} \tag{14}$$

with $\mu_i \sim \mathrm{IID}(0,\sigma_\mu^2)$, $\lambda_t \sim \mathrm{IID}(0,\sigma_\lambda^2)$ and $v_{it} \sim \mathrm{IID}(0,\sigma_v^2)$; $i = 1, \ldots, 24,\ t = 1, \ldots, T_i IRS_{it-1}$ is interest rate spread of bank i in period $t-1$.

The error term, u_{it} in (14) is composed of the time-specific effects (λ_t), individual bank-specific effects (μ_i), and the remainder error term (v_{it}).

IRS in equation (13) is interest rate spreads—the dependent variable of this study. Following Chirwa and Mlachila (2004) and Mugume et al. (2009), we measure interest rate spreads as the difference between the ratio of interest received to total loans, and the ratio of interest paid to total deposits for individual commercial bank in a given year. Ideally, interest rate spreads would have been defined as the difference between the weighted average lending, and

weighted average savings and time deposit rate for individual commercial banks (Sologoub, 2006). However, data on ex-ante interest rates is not available given that financial statements of commercial banks do not report such information.

The explanatory variables of the study in (13) are composed of bank-specific characteristics, banking industry-specific variables, and macroeconomic factors. We expand the vectors of the three categories of independent variables for independent variable description. The expansion of the vector of bank-specific characteristics in (13) gives:

$$\sum_{j=1}^{7} \beta_j X_{it}^{j} = \beta_1 CR_{it} + \beta_2 LR_{it} + \beta_3 BS_{it} + \beta_4 OC_{it} + \beta_5 ROA_{it} + \beta_6 NII_{it} + \beta_7 CAR_{it} \qquad (15)$$

CR is the credit risk. As in Ahokpossi (2013), we measure credit risk as the ratio of non-performing loans to total loans. Credit risk shows the possibility of loan default by bank customers. As credit risk increases, financial institutions are expected to raise their lending rates to compensate for lost interest revenue due to loan default (Chirwa & Mlachila, 2004; Grenade, 2007; Jamaludin et al., 2015; Mugume, et al., 2009). As such, a positive relationship between credit risk and interest rate spreads is expected in this study.

LR is the liquidity risk. It shows the possibility of a bank being unable to meet its short-term financial demands of its customers, as well as its short-term expenses. Following, among others, Ahokpossi (2013), and Beck and Hesse (2009), liquidity risk is measured as a ratio of liquid assets to deposits and short-term financing. Financial institutions with high liquidity risk tend to keep high levels of reserves over and above the regulatory reserve requirements, or borrow emergency funds at high costs in the interbank market. This is a self-imposed cost to banks for prudential reasons, or because of regulation (reserve requirements). Thus, banks charge a liquidity premium to compensate liquidity risk, leading to higher spreads (Beck & Hesse, 2009; Islam & Nishiyama, 2016; Mannasoo, 2012). *A priori*, a positive relationship is assumed between liquidity risk and interest rate spreads.

BS is the bank size. Following Beck and Hesse (2009) and Almarzoqi and Naceur (2015), it is measured using total assets of individual banks in each year. A logarithm of the total asset is taken to reduce the magnitude of the figures whilst maintaining the properties of the variable. Bank size is used to test the existence of economies of scale. Bigger banks are expected to attract a large pool of deposits, leading to favourable lending rates in addition to a large volume of loans (Beck & Hesse, 2009). Premised on this, the study expects a negative relationship between bank size and interest rate spreads.

OC is operating costs. As in Mugume et al. (2009), it is measured as a ratio of operating costs to total assets. A higher cost of financial intermediation will drive

up interest rates on loans whilst depressing interest rates on deposits, hence wide interest rate spreads (Grenade, 2007; Mugume, et al., 2009). Thus, the study expects operating costs and interest rate spreads to be directly proportional.

ROA is the return on assets. It is used as an indicator of how profitable a bank is relative to its total assets. As in Siddiqui (2012), return on assets is calculated as net income divided by average total assets of a bank. *A priori,* it is expected that return on assets positively affect interest rate spreads given that more profitable banks, on average, also charge higher spreads and earn higher margins (Beck & Hesse, 2009).

NNI is the non-interest income. As in Maudos and Solis (2009), it is measured as the ratio of non-interest income to total assets. It measures the contribution of non-core business activities—commission, brokerage fees, capital gains, dividends, and income from foreign exchange transactions, among others—towards the profitability of a bank. Banks with diversified and stable revenue sources are expected to influence the pricing of loan products, and therefore may charge lower margins due to subsidisation of traditional banking activities (Carbo & Rodriguez, 2007; Maudos & Solis, 2009; Mujeri & Younus, 2009). Therefore, a negative relationship between non-interest income and interest rate spreads is expected.

Finally, *CAR* is capital adequacy ratio. It is measured as the total shareholder's equity divided by risk-weighted assets. The changes in capital requirements have a direct impact on a bank's optimal interest rate spreads. An increase in the capital adequacy ratio is shown to increase interest rate spreads under the reasonable assumption of risk aversion (Ahokpossi, 2013).

The expansion of the vector of banking industry-specific variables in (13) gives:

$$\sum_{k=1}^{2} \eta_l X_t^l = \eta_1 HHI_t + \eta_2 FOREIGN_t \qquad (16)$$

HHI is the Herfindahl-Hirschman index (deposit and loan). It measures market concentration in the banking sector. As in Mugume et al. (2009), the *HHI* is computed as the sum of the square of the market share (loans or deposits) of each bank. An *HHI* of below 0.01 indicates a highly competitive market, whilst an *HHI* of between 0.01and 0.1 indicates an unconcentrated market. Furthermore, an *HHI* of between 0.1 and 0.18 indicates a moderately concentrated market, and an *HHI* of above 0.18 indicates a highly concentrated market. The calculation of *HHI* takes into account the relative size and distribution of banks in a market, and approaches zero when a market consists of many banks of relatively equal size. A highly concentrated market promotes collusive behaviour among banks, particularly in pricing (Ahokpossi, 2013; Almarzoqi & Naceur, 2015; Jamaludin et al., 2015). Hence, a positive relationship is expected between *HHI* and interest rate spreads.

FOREIGN is the foreign bank participation. As in Beck and Hesse (2009), it measures the market share of foreign banks in the loans market. Generally, increased foreign bank participation is associated with lower bank spreads (Ahokpossi, 2013). As such, a negative relationship is expected.

The expansion of the vector of macroeconomic factors in (13) yields:

$$\sum_{m=1}^{5} \phi_m X_t^m = \phi_1 INF_t + \phi_2 RGDP_t + \phi_3 TBR_t + \phi_4 ERV_t + \phi_5 M2/GDP_t \qquad (17)$$

INF is inflation. It is measured as the annual change in consumer price index. A higher rate of inflation is expected to lead to higher interest rate spreads given that it reduces real interest rates (Almarzoqi & Naceur, 2015).

RGDP is the annual reeled growth rate. As output growth slows down during a business cycle, creditworthiness deteriorates. Other things being equal, this is likely to be reflected in higher bank loan rates, leading to higher interest rate spreads (Beck & Hesse, 2009; Nampewo, 2013).

TBR is the Treasury bill rate. It is used to measure interest rate risk in the money market. As in Mugume et al. (2009), it is measured as a 91-day annualized Treasury bill rate. Unlike loans, Treasury bills are risk-free given that they are backed by the government. This makes them safer forms of investment. An increase in Treasury bill rate induces banks to invest in these short-term instruments instead of loans. This reduces the amount of reserves available for advancing credit to the public, hence high interest rate spreads (Nampewo, 2013). To that effect, a positive relationship is expected between interest rate spreads and Treasury bill rates.

ERV is exchange rate volatility. It is used to measure external macroeconomic instability. Following Folawewo and Tennant (2008), exchange rate volatility for each year is calculated as the standard deviation of the percentage change in the real UGX/US$ exchange rate for the preceding three years. Since increased macroeconomic instability heightens the risk faced by commercial banks, exchange rate volatility is expected to be positively correlated with interest rate spreads (Beck & Hesse, 2009; Folawewo & Tennant, 2008).

Lastly, M*2/GDP* is broad money supply to GDP. It is used as a measure of the level of financial development. It captures the degree of monetisation in the financial system of an economy. A lower level of monetisation of the financial system may reflect lower level of efficiency in the intermediation process, thus leading to higher spreads (Crowley, 2007; Folawewo & Tennant, 2008; Nampewo, 2013). In Uganda, the M2/GDP ratio shows an increasing trend. Therefore, a negative relationship between M2/GDP and interest rate spreads is expected.

3.3 Estimation Techniques

Unlike static panel data models, the dynamic panel data regression described in (13) is characterised by two sources of persistence over time: autocorrelation due to the

presence of a lagged dependent variable among the independent variables; and individual effects characterising the heterogeneity among the individuals. Consequently, this persistence over time renders the static panel estimation methods of pooled ordinary least squares (OLS), fixed effects, and random effects biased and/or inconsistent (Arellano & Bond, 1991; Baltagi, 2005). The problems of biasness and inconsistency associated with static panel estimators in dynamic panel data have been dealt with by, among others, Anderson and Hsiao (1981), Arellano and Bond (1991), Ahn and Schmidt (1995), Arellano and Bover (1995), and Blundell and Bond (1998) using either instrumental variables (IV), or generalised method of moments (GMM) estimation methods. This study uses the GMM estimation methods given that they are more efficient than the IV estimation method (Ahn & Schmidt, 1995).

On the GMM estimation methods, Arellano and Bover (1995), Blundell and Bond (1998), and Bond (2002) note that the first difference GMM estimator of Arellano and Bond (1991) has poor finite sample properties. It is biased downwards, particularly when the time dimension (T) is small. In this study, $T = 11$ and $N = 24$. Consequently, we use the system GMM estimator—the optimal combination of first difference GMM and levels GMM estimators—to improve the precision and reduce the finite sample bias common with the Arellano and Bond estimator (Blundell, Bond & Windmeijer, 2000). In addition, we use the two-step procedure given that the two-step system GMM estimator is asymptotically more efficient compared to the one-step estimator (Arellano & Bond, 1991; Blundell & Bond, 1998). We restrict lagged instruments to the third lags of the endogenous variable. This is because the systems GMM estimator is prone to proliferation of instruments, which could lead to inconsistent estimates (Roodman, 2009).

Furthermore, the consistency of the system GMM estimator depends on the validity of the over-identifying restrictions. As such, we use the Sargan test for over-identifying restrictions to test for the validity of the moment conditions used in GMM estimation procedure. Lastly, the consistency of the system GMM estimator relies on the fact that $E(\Delta v_{it}\Delta v_{i,t-2}) = 0$ (Baltagi, 2005). The study uses the Arellano and Bond (1991) Hausman-type test for first- and second-order serial correlation for disturbances of the first differenced equation.

3.4 Data Sources

We obtain the data on bank-specific and industry-specific variables from the audited financial statements of 24 commercial banks in the study for the period 2005-2015.[7] For macroeconomic variables, data on inflation and real GDP growth rate were collected from the Uganda Bureau of Statistics (UBOS). In addition, data on exchange rate volatility and 91-day Treasury bill rate was collected from the Bank of Uganda. Lastly, data on M2/GDP was collected from the World Bank's *World Development Indicators Database*. Table A2 shows the data sources for each variable.

[7] See Appendix A for the list of banks

4. Results

4.1 Data Characteristics

4.1.1 Descriptive Statistics

We use STATA 15.0 to examine the data characteristics and run regression equations. Table 2 presents the descriptive statistics of the data used in empirical analysis. From Table 2, there are 198 observations on interest rate spread (IRS) with a mean of 18.43%. As noted in section 1, this mean interest rate spread is higher than the regional and global averages. Moreover, 18.23% standard deviation of interest rate spreads from the mean points suggests that there is a significant variation in interest rate spreads across banks. The minimum and maximum interest rate spreads during the period were -4.41% and 40.86%, respectively. Both the minimum and maximum interest rate spreads were registered by start-up banks in their first year of operations. This could suggest that even among start-up banks, there are significant variations in their intermediation efficiencies even if they are established in the same year.

Table 2: Descriptive Statistics

Variable	Observations	Mean	Standard Deviation	Minimum	Maximum
IRS	198	0.1843	0.1823	−0.0441	0.4086
CR	196	0.0226	0.0309	−0.0057	0.2007
LR	196	0.8900	1.0466	0.2150	2.5383
BS	198	11.5057	0.5376	10.2626	12.5716
OC	198	0.0850	0.0577	0.0214	0.5162
ROA	198	0.0156	0.0364	−0.1773	0.1390
NII	198	0.0401	0.0220	0.0011	0.1437
CAR	146	0.3295	0.2497	0.1042	1.3619
HHI (LOAN)	198	0.1176	0.0256	0.0943	0.1840
HHI (DEPOSIT)	198	0.1226	0.0365	0.0894	0.2033
FOREIGN	198	0.8036	0.0272	0.7725	0.8571
INF	198	0.0893	0.0484	0.0399	0.1868
RGDP	198	0.0627	0.0218	0.0356	0.1078
TBR	198	0.1077	0.0355	0.0501	0.1583
ERV	198	0.0570	0.0290	0.0170	0.1034
M2/GDP	198	0.2123	0.0130	0.1932	0.2362

Source: Author's calculations

Given that credit risk (CR) was defined as a ratio of non-performing loans to total loans, then descriptive statistics show that, on average, 2.26% of the loans of the banking sector were non-performing loans during the period 2005−2015. This is a relatively low level of non-performing loans to total loans ratio. However, credit risk differs from bank to bank as the minimum and maximum level of credit risk during the period was -0.57% and 20.07%, respectively. Negative values of the variables are attributed to the recovery of loans that were formerly classified as bad debts by a few banks in some years.

Liquidity risk (LR) averaged 89% with a minimum and maximum of 21.50% and 2.53%, respectively. Start-up banks had more liquid assets relative to deposits in

their initial years of operation. Since the liquidity ratio was measured as a ratio of liquid assets to deposits of each bank in each year, the statistics point to the stability of the banking sector in Uganda.

Bank size (BS), in terms of absolute assets, averaged UGX613.5bn for the period 2005-2015. The lowest value of assets was UGX18.3bn owned by a start-up bank in its first year of operation, whilst the highest value of assets was UGX 3,729.1bn. In terms of logged values, bank assets averaged at 11.51 with a minimum of 10.27 and a maximum of 12.57. As expected *a priori*, large banks over the period of study were traditional foreign banks, whilst small banks were generally banks that were started recently.

As far as operating costs are concerned, banks used on average 8.5% of total assets in operating expenses. The maximum operating costs/assets ratio (51.62%) was incurred by a new bank during its second year of operation, whilst the minimum operating costs/assets ratio (2.14%) was incurred by traditional foreign-owned banks. This, as also noted by Beck and Hesse (2009), suggests that established banks incur relatively lower operating expenses compared to start-up banks.

The average return on assets (ROA) for all banks was 1.56%; with a minimum and maximum return on assets of -17.73% and 13.9%, respectively. Paradoxically, the minimum and maximum return on assets were both registered by new banks in their first year of operation. Moreover, some of the new banks made profits in their first year of operation, whilst others took more than 8 years to break even, thus pointing to differences in the efficiency of start-up banks.

Non-interest income (NNI) averaged 4.01% during the period. The minimum non-interest income (1.1%) was recorded by a start-up bank, whilst the maximum non-interest income (14.37%) was earned by an established bank. Generally, statistics show that Uganda's commercial banking sector is less diversified. Further still, established banks have more diversified activities compared to new banks.

Capital adequacy ratio (CAR) had an average of 32.95%, with a minimum of 10.42% and a maximum of 136.19%. Given the relatively high ratio of equity to risk weighted assets, the descriptive statistics suggest that the banking sector is well capitalised, and thus stable.

For industry-specific factors, HHI (loan) averaged at 0.1176, with a minimum and maximum of 0.0943 and 0.1840, respectively; whilst HHI (deposit) averaged at 0.1226, with a minimum and maximum of 0.0894 and 0.2033, respectively. Thus, Uganda's banking sector is moderately concentrated given that both the HHI (loan) and HHI (deposit) averages are within the range of the HHI of moderately concentrated markets (0.1 to 0.18). Moreover, the descriptive statistics also show that there is relatively more concentration in the deposits market compared to the loans market. Whilst foreign bank participation in the loans markets

(FOREIGN) averaged at 80.36%, the minimum and maximum levels of foreign bank participation were 77.25% and 85.71%, respectively. Generally, Uganda's banking sector is dominated by foreign-owned banks. This dominance is partly attributed to the financial liberalisation policy that led to the entry of many foreign banks.

Turning to macroeconomic variables, inflation (INF) averaged at 8.93% with a recorded minimum and maximum of 3.99% and 18.68%, respectively. The highest level of inflation was recorded in 2011. The high inflation could probably explain the high lending rates that were charged by banks in that year. Generally, high inflation rates increase the cost of doing business and reduce real interest rates; which often lead to an increase in nominal interest rates, especially lending rates, by banks.

Real GDP growth (RGDP) averaged at 6.27%, with the highest level of economic growth (10.78%) recorded in 2006, whilst the lowest level of growth (3.56%) was recorded in 2013. The descriptive statistics show a relatively sustained trend of economic growth over the period of study. Overall, high growth rates are associated with better performance of the banking sector and lower interest rate spreads.

The 91-day Treasury bill rate (TBR) averaged 10.77%, with minimum and maximum rates of 5.01% and 15.83%, respectively. The high Treasury bill rates are indicative of high levels of government domestic borrowing. Holding other factors constant, governments often set high interest rates to attract more investors in purchasing government securities to finance budget deficits.

Exchange rate volatility (ERV) averaged 0.057, with a recorded minimum and maximum of 0.017 and 0.1034, respectively. Since each year's exchange rate volatility was measured as the standard deviation of US$/UGX exchange rate for the preceding three years, the statistics suggest that there was high volatility in exchange rates over the period of study. Holding other factors constant, volatility in exchange rates is associated with wider interest rate spreads.

Finally, broad money supply to GDP (M2/GDP) averaged 21.23% for the period of study, with a minimum of 19.32% recorded in 2005 and a maximum of 23.62% recorded in 2008. Overall, M2/GDP has been increasing over time though still low; thus, pointing to the low level of development of the financial sector.

4.1.2 Pairwise Correlation Matrices of Variables

Multicollinearity leads to inefficient estimates though it does not violate OLS assumptions (Carl & Praveen, 2002). Extreme multicollinearity is tested using pairwise correlation matrix. The bank-specific variables have between 146 and 198 observations. Industry-specific and macroeconomic variables have observations for 11 years, but repeated across panels, this gives 198 observations for bank-specific and macroeconomic variables. Furthermore, bank-specific

variables vary both across cross-sections and over time, whilst industry-specific and macroeconomic variables only vary over time. As such, we run two separate pairwise correlation matrices for these groups of variables given their distinct characteristics to ascertain extreme multi-collinearity among variables. The pairwise correlation matrices of bank-specific variables, industry-specific and macroeconomic variables are presented in Tables 3 and 4, respectively.

Table 3: Correlation Matrix of Bank-specific Variables

	IRS	CR	LR	BS	OC	ROA	NII	CAR
IRS	1.000							
CR	−0.013	1.000						
LR	0.016	0.002	1.000					
BS	−0.028	−0.014	−0.220***	1.000				
OC	−0.027	0.096	−0.016	−0.365***	1.000			
ROA	0.087	−0.308***	−0.080	0.371***	−0.594***	1.000		
NII	−0.040	0.156**	−0.217***	−0.037	0.325***	−0.056	1.000	
CAR	0.1918**	0.039	0.541***	−0.559***	0.043	−0.072	−0.181**	1.000

Notes: ***, **, and * indicates that the correlation coefficients are significant at 1%, 5%, and 10% respectively

Source: Author's calculations

Table 4: Correlation Matrix of Market-specific and Macroeconomic Variables

	IRS	HHI (LOAN)	HHI (DEPOSIT)	FOREIGN	INF	RGDP	TBR	EVR	M2/ GDP
IRS	1.000								
HHI (LOAN)	0.293***	1.000							
HHI (DEPOSIT)	0.263***	0.986***	1.000						
FOREIGN	0.010	0.148**	0.120*	1.000					
INF	–0.004	0.074	0.085	0.087	1.000				
RGDP	0.024	0.620***	0.646***	0.116	0.401***	1.000			
TBR	–0.063	–0.388***	–0.416***	0.254***	0.390***	–0.188***	1.000		
ERV	0.146**	–0.193***	–0.218***	–0.012	–0.124*	–0.696***	0.473***	1.000	
M2/GDP	–0.208***	–0.250***	–0.227***	0.445***	–0.099	0.199***	0.008	–0.342***	1.000

Notes: ***, **, and * indicates that the correlation coefficients are significant at 1%, 5%, and 10% respectively

Source: Author's calculations

Overall, severe multi-collinearity that compromises efficiency of regression results is neither detected among bank-specific variables nor industry-specific and macroeconomic variables. However, this conclusion excludes the correlation between HHI (loan) and HHI (deposits). HHI (loan) and HHI (deposits) are highly and significantly correlated (0.986) at 1%. This high correlation is expected given they both measure the level of market concentration in the banking industry. As such, HHI (loan) and HHI (deposits) are interchangeably, rather than concurrently, run in regressions to remedy collinearity.

4.1.3 Panel Unit Root Tests

We use combined-value tests (ADF-Fisher type and PP-Fisher type tests) to test for stationarity of the data since they assume individual unit root processes, and do not require balanced panels. These tests include Fisher's inverse chi-square (P) test, inverse normal (Z) test, the logit (L*) test, and modified inverse chi-square (Pm) test. Overall, the Z test is reported to outperform other tests, and is thus recommended (Baltagi, 2005). However, since all the four tests are reported in Fisher-type unit root tests in STATA output, we use all in ascertaining the stationarity of data. In all cases, the null hypothesis is that all panels contain unit roots, whilst the alternative hypothesis is that at least one panel is stationary. Table 5 presents ADF-Fisher type tests, whilst PP-Fisher type tests are presented in Table A3.

Table 5: Panel Unit Root Tests: ADF-Fisher Type Tests

Variable	P	Z	L*	Pm
IRS	246.397***	−7.958 ***	−13.248***	20.893 ***
CR	97.037***	−3.498***	−4.104***	5.321***
LR	290.836***	−8.396***	−15.596***	25.526***
BS	87.841***	−3.119***	−3.412***	4.066***
OC	191.623***	−4.962***	−9.236***	14.659***
ROA	90.85***	−3.504***	−4.004***	4.374***
NII	147.073***	−5.178***	−7.307***	10.112***
CAR	156.670***	−3.950***	−7.432***	11.538***
HHI (LOAN)	122.835***	−6.543***	−6.711***	7.638***
HHI (DEPOSIT)	137.555***	−5.590***	−7.221***	9.140***
FOREIGN	99.902***	−5.037***	−4.941***	5.297***
INF	220.723***	−7.692***	−12.515***	17.629***
RGDP	82.021***	−3.489***	−3.770***	3.472***
TBR	44.209***	−1.345***	−1.253***	−0.387***
ERV	74.183***	−3.645***	−3.476***	2.672***
M2/GDP	220.021***	−10.125***	−12.292***	17.557***

Note: P is the inverse chi-squared statistic; Z is the inverse normal statistic; L* is the inverse logit statistic; and Pm is the modified inverse chi-squared statistic.
***, **, and * indicates significance of the unit root statistics at 1%, 5%, and 10% respectively.

Source: Author's calculations

All unit root test statistics for all variables are statistically significant at 1%. The significance of the unit root tests, therefore, leads to the rejection of the null hypothesis at 1% for all variables. That is, all variables do not have a unit root, or are *I(0).*

4.2 Presentation, Interpretation, and Discussion of Regression Results

As noted in section 3.3, we use dynamic panel estimation techniques (two-step systems GMM) to run interest rate spreads equations. Table 6 presents the regression results.

Table 6: Dynamic Panel Regressions: Two-step System GMM

IRS	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
IRS(L1)	0.1194	0.1469	0.1343	0.0408	0.0061
	(0.0558)**	(0.0653)**	(0.0668)**	(0.0778)	(0.0697)
CR	0.3659	0.4285	0.3965	0.2882	0.2809
	(0.1239)***	(0.1493)***	(0.1484)***	(0.1322)**	(0.1276)**
LR	0.0297	0.0286	0.0324	0.0340	0.0410
	(0.0112)***	(0.0134)**	(0.0145)**	(0.0206)*	(0.0219)*
BS	−0.0158	−0.0463	−0.0044	−0.0217	−0.0190
	(0.0190)	(0.0265)*	(0.0280)	(0.0249)	(0.0249)
OC	− 0.2828	−0.2789	−0.4555	0.5615	−0.6069
	(0.0995)***	(0.1300)**	(0.1430)***	(0.3009)*	(0..2925)*
ROA	0.0923	0.3994	0.1369	0.0196	−0.0110
	(0.3434)	(0.4746)	(0.4618)	(0.6669)	(0.6570)
NII	0.8968	0.8776	0.9397	0.6507	0.7055
	(0.2214)***	(0.4252)**	(0.3733)**	(0.3795)*	(0.3630)*
CAR	0.1107	0.1163	0.0947	0.1221	0.1268
	(0.0231)***	(0.0220)***	(0.0131)***	(0.0281)***	(0.0269)***
HHI (LOAN)		−0.1004		0.6785	
		(0.3013)		(0.7015)	
HHI			0.0581		0.4690
(DEPOSIT)			(0.2880)		(0.4582)
FOREIGN		0.1758	0.1782	0.4193	0.4040
		(0.0836)**	(0.0870)**	(0.2040)**	(0.2019)**
INF				0.2500	0.2007
				(0.1172)**	(0.1365)
RGDP				−0.9171	−0.7762
				(0.4463)**	(0.4636)*
TBR				−0.0978	−0.0626
				(0.1821)	(0.1924)
ERV				−0.4249	−0.4575
				(0.2666)	(0.2435)*
M2/GDP				−1.4080	−1.5690
				(0.5095)***	(0.5462)***
CONS	0.2577	0.1822	−0.0455	0.3363	0.3304
	(0..1548)*	(0.2609)	(0.3182)	(0.3329)	(0.3331)
No. of obs.	133	133	133	133	133
No. of banks	24	24	24	24	24
AB AR(2) [P-values]	[0.1956]	[0.1787]	[0.1701]	[0.6425]	[0.9156]
Sargan test	$\chi^2(53)$	$\chi^2(53)$	$\chi^2(53)$	$\chi^2(53)$	$\chi^2(53)$
	=15.6826	=13.9531	=18.8473	=6.1972	=6.15796
P-values	[1.0000]	[1.0000]	[1.0000]	[1.0000]	[1.0000]
Wald	$\chi^2(8)$	$\chi^2(10)$	$\chi^2(10)$	$\chi^2(15)$	$\chi^2(15)$
χ^2statistic	=1861.63***	=949.84***	=1550.90***	=1666.18***	=1590.68***

Notes: Standard errors in parentheses

***, **, and * indicates significance at 1%, 5%, and 10% respectively

AB = Arellano and Bond test of autocorrelation in differenced errors

Source: Author's calculations

We run five regressions in total. Regression (1) contains only bank-specific factors as explanatory variables, whilst regressions (2) and (3) have bank-specific and industry-specific factors as explanatory variables. However, due to collinearity, regression (2) uses HHI (loan) to measure market concentration, whilst regression (3) uses HHI (deposit). Finally, regressions (4) and (5) have all the three categories of variables (bank-specific, industry-specific and macroeconomic factors). Again, due to collinearity between HHI (loan) and HHI (deposit), regression (4) is run with HHI (loan), whilst regression (5) is run with HHI (deposit) as a measure of market concentration.

As far as general specification of the dynamic panel regressions is concerned, the Wald χ^2 statistic is significant at 1% in all regressions. Thus, we reject the null hypothesis that all coefficients, in each regression, are simultaneously equal to zero. The rejection of the null implies that the models explain the variations in interest rate spreads. In addition, the Sargan test of over-identifying restrictions fails to reject the null hypothesis that over-identifying restrictions are valid in all regressions. As such, there is no over-identification of instruments in all models. Furthermore, Arellano and Bond (1981) test for second-order autocorrelation in the error term component is insignificant at 1% in all regressions. That is, there is no second order autocorrelation in error term. This is in line with the assumptions of dynamic panel estimation: the error term can have first-order autocorrelation but there ought to be no second-order autocorrelation.

From the regression results in Table 6, on one hand, the first lag of interest rate spread (IRS_{it-1}), credit risk (*CR*), liquidity risk (*LR*), bank size (*BS*), non-interest income (*NII*), capital adequacy ratio (*CAR*), foreign bank participation (*FOREIGN*), inflation rate (*INF*), real GDP growth rate (*RGDP*), exchange rate volatility (*EVR*), and M2/GDP are variables that are shown to significantly affect interest rate spreads. On the other hand, return on assets (*ROA*), *HHI*, and Treasury bill rates (*TBR*) are shown to be insignificant determinants of interest rate spreads and, as such, these factors are not considered in the interpretation and discussion of the results.

To start with, the first lag of interest rate spreads (IRS_{it-1}) is positively related to the interest rate spreads in all regressions. However, the coefficients of IRS_{it-1} are only significant at 5% in regressions (1), (2), and (3); and insignificant in overall regressions 4 and 5 that include macroeconomic variables. Nevertheless, the results imply that higher interest rate spreads in the previous period are associated with higher interest rate spreads in the current period. These findings are consistent with *a priori* expectations of the study and empirical literature that associate higher interest rate spreads in previous periods with higher spreads in current periods (Carbo & Rodriguez, 2007; Folawewo & Tennant, 2008).

As expected, higher credit risk (*CR*) is associated with higher interest rate spreads in all regressions. That is, an increase in credit risk translates into higher bank spreads. The coefficients are significant at 1% in regressions with only bank-

specific and/or bank-specific variables (regressions: 1, 2, and 3); and significant at 5% in overall regressions 4 and 5. Given that credit risk is measured as a ratio of non-performing loans to total loan portfolio, the results are in line with literature that associates high levels of non-performing loans (high credit risk) with higher bank spreads. Specifically, the findings are similar to those of Ahokpossi (2013), Mugume et al. (2009), among others. Generally, both empirical and theoretical literature acknowledge that higher credit risk resulting from high default rates reduces bank profitability due to loan-loss provisions. Thus, high interest spreads are a risk premium for lending to high-risk borrowers.

Liquidity risk (LR) is positively related to interest rate spreads in all regressions. Liquidity risk is significant at 1% in regression (1); at 5% in regressions (2) and (3); and at 10% in regressions (4) and (5). Overall, regression results on liquidity risk are in line with the hypothesis of the study. Without any contradiction, the results are in support of literature that show that high liquidity ratios are used by banks to safeguard against sudden withdrawals by customers, thus leading to high interest rate spreads (Beck & Hesse, 2009; Islam & Nishiyama, 2016; Mannasoo, 2012).

Results show that bank size (BS) negatively drives interest rate spreads in all regressions. The results show that an increase in the size of a bank leads to a decrease in interest rate spreads. Though this is in line with the expectations of the study, the variable is significant at 10% in only regression (2) and insignificant in all other regressions. Nonetheless, all coefficients in the five regressions suggest that bank size negatively affects interest rate spreads. These results are in agreement with the small financial system hypothesis and most of empirical literature that associate larger banks with lower bank spreads (Almarzoqi & Naceur, 2015; Beck & Hesse, 2009; Willmott, 2012). The small financial system hypothesis attributes the reduction in interest rate spreads to economies of scales that large banks tend to enjoy relative to smaller banks.

The results of operating costs (OC) are mixed. Regression (4), as expected, show that operating costs positively affect interest rate spreads, though significant at 10%. These findings are consistent with the efficiency hypothesis, which attributes higher bank spreads to operational inefficiency; that is, higher operational costs translate into higher interest rate spreads. In addition, the findings are in line with empirical literature that associates high interest rate spreads with high operational costs (Mugume et al., 2009; Mujeri & Younus, 2009; Siddiqui, 2012). This could be explained by the tendency of banks to transfer their higher operating costs to customers in the form of low deposits and/or high lending rates, thus leading to high interest rate spreads. On the contrary, though, regressions (1), (2), (3), and (5) show that operating costs negatively affect interest rate spreads. Moreover, coefficients for regressions (1) and (3) are significant at 1%, while coefficients of regressions (2) and (5) are significant at 5% and 10%, respectively. There is no clear explanation to this contradiction in the results in both theory and empirical literature, and as such there is need for more investigation.

In contrast to *a priori* expectation, the results associate higher interest rate spreads with higher non-interest income (NII) in all regressions. The variable is significant at 1% in regression (1); 5% in regressions (2) and (3); and 10 percent in regressions (4) and (5). As such, diversification of the banking sector seems to be linked with higher bank spreads. This also contrasts empirical literature such as by Almarzoqi and Naceur (2015), Carbo and Rodriguez (2007), Mujeri and Younus (2009), and Mugume et al. (2009), which associate higher non-interest income with lower bank spreads. These studies consider non-interest income somewhat as a form of compensation for lower revenues due to lower bank spreads and margins. To that effect, the conclusion is always that as non-interest income declines, banks raise lending rates to compensate for loss in income and vice versa. However, the contradiction between the study findings and other empirical literature could partly be attributed to market concentration, which is often enhanced by increment in a banks' revenue. In fact, market concentration is found to be positively related with interest rate spreads in the study. Moreover, Willmott (2012) notes that, on average, banks with diversified operations and that incur lower costs, do not necessarily charge lower interest rates in Uganda. Furthermore, non-interest income is directly proportional to the volume of transactions in the deposits and loans markets. To that effect, the calculation of interest rate spreads using interest revenue and expenditure could partly explain why the findings of the study associate an increase in non-interest income with higher interest rate spreads.

All regression results show that capital adequacy ratio is directly proportional to interest rate spreads in all regressions. Thus, an increase in the ratio of equity to risk weighted assets leads to an increase in interest rate spreads. The variable is significant at 1% in all regressions. The findings of the study are consistent with empirical literature: that is, capital adequacy ratio is positively related to interest rate spreads (Ahokpossi, 2013; Almarzoqi & Naceur, 2015; Crowley, 2007). This is based on the reasoning that, under the assumption of risk aversion, shareholders usually demand higher returns on their additional equity. Moreover, banks with higher equity are reluctant to increase deposit rates given that they can make loans using their capital, hence leading to wider spreads (Chirwa & Mlachila, 2004).

Foreign bank participation in the loans market (*FOREIGN*) is associated with higher interest rate spreads in all regressions. The coefficients of foreign bank participation are significant at 5% in all regressions containing it as an independent variable, i.e., regressions (2), (3), (4), and (5). These findings are consistent with those of Beck and Hesse (2009), and Crowley (2007), which show that the foreign share of bank ownership and foreign bank share in the loans market, respectively, are positively related to interest margins and spreads. The high interest spreads among foreign-owned banks, just as it is the case with other developing countries, could partly be due the limited competitive pressures the banks face from local banks (Demirguc-Kunt & Huizinga, 1999). In fact, over 80% of Uganda's banking sector assets are controlled by foreign banks. On the contrary, though, the results disagree with Ahokpossi (2013) who shows that foreign ownership leads to lower interest margins. Overall, foreign bank participation in the banking sector is associated with high interest rate spreads in Uganda.

Inflation (*INF*) is positively related to interest rate spreads in both regressions with macroeconomic variables. An increase in the annual inflation rate, as expected, leads to an increase in interest rate spreads. Generally, inflation leads to a decline in real interest rates, which prompts banks to increase their nominal lending rates, hence leading to wide bank spreads. However, inflation is significant in only regression (4) at 5%. Nonetheless, it is agreeable in all regressions that higher inflation rates are associated with higher interest rate spreads. This is in line with the macroeconomic view of interest rate spreads that postulates inflation to be positively related to bank spreads. According to the theory, inflation leads to decrease in real interest rates, and as such banks tend to set wide spreads to compensate for loss. Furthermore, the findings of the study are consistent with empirical literature such as those of Ahokpossi (2013), Almarzoqi and Naceur (2015), Beck and Hesse (2009), Chirwa and Mlachila (2004), and Mugume et al. (2009). But the study results are totally in disagreement with the findings of Crowley (2007), which show that inflation rate negatively affects bank spreads.

The level of real GDP growth (*RGDP*), as expected *a priori*, is negatively related to interest rate spreads in both regressions. In addition, its coefficients are significant at 5% and 10% in regressions (4) and (5), respectively. The study findings are consistent with the macroeconomic hypothesis that associates an increase in real GDP growth rates with a reduction in interest spreads. Furthermore, the findings are also in line with findings on GDP growth in empirical literature (see, e.g., Beck & Hesse, 2009; Crowley, 2007; Islam & Nishiyama, 2016; Mugume et al., 2009). However, the findings by Grenade (2007) that show real GDP growth to be directly proportional to bank spreads are in disagreement with the study findings.

Exchange rate volatility (*ERV*) also negatively affects interest rate spreads in regressions (4) and (5). Its coefficient is significant at 10% in regression (5), but it is shown to be an insignificant determinant of interest spreads in regression (4). These findings are inconsistent with the macroeconomic view of interest rate spreads and most of the empirical literature that often associate higher exchange rate volatility with higher interest rate spreads. However, contrary to the study findings, Beck and Hesse (2009), Crowley (2007), Folawewo and Tennant (2008), Mugume et al. (2009), and Nampewo (2013) show that exchange rate volatility is positively related to interest spreads. This is hinged on the notion that uncertainty in the foreign exchange market affects the profitability of banks, especially foreign-owned banks. In contradiction with this, however, the current study finds that exchange rate volatility is negatively related to interest rate spreads, though the coefficients are not significant. This could probably be attributed to the preference by most banks to lend in the local currency given the volatility in the foreign exchange market. As such, it could be inferred that banks tend to lower interest rates on local currency denominated loans to induce customers to borrow in local currencies instead of highly volatile foreign currencies.

Lastly, high levels of broad money supply to GDP (M2/GDP) are associated with lower interest rate spreads. Moreover, it is shown to be a statistically significant determinant of interest rate spreads at 1% in both regressions that include it (M2/GDP) as an explanatory variable. Bearing in mind that M2/GDP is used as a proxy of the level of financial sector development, the results show that high levels of financial development lead to lower bank spreads. Generally, financial sector development is associated with an increase in the outreach and scope of financial services (financial deepening and widening), which increase competition in financial markets, and thus result into lower bank spreads (Demirguc-Kunt et al., 2017). The study findings on M2/GDP are in agreement with the macroeconomic view of interest rate spreads and empirical literature such as Crowley (2007).

4.3 Summary of the Findings

Results from the system GMM regressions show that among the bank-specific factors, interest rate spreads significantly increase by an increase in credit risk, liquidity risk, non-interest income, and capital adequacy ratio. On the other hand, bank size is shown to be negatively related to interest rate spreads. Results on operating costs and return on assets are inconclusive. However, unlike return on assets, operating costs are shown to be significant determinants of interest rate spreads in all regressions by four out of five regressions, contrary to the *a priori* expectations showing that operating costs are associated with a reduction in interest rate spreads.

As far as banking industry factors are concerned, foreign bank participation is positively and significantly related to interest rate spreads. Results on *HHI* are inclusive and insignificant. In the case of macroeconomic variables, results show that high inflation rates translate into high bank spreads, whilst high real gross domestic product (GDP) growth rates, high exchange rate volatility, and high levels of broad money supply to GDP (M2/GDP) are associated with lower bank spreads. Paradoxically, 91-day Treasury bill rate and exchange rate volatility are associated with lower bank spreads. However, coefficients for 91-Treasury bill rate are not significant. The lagged interest rate spreads are shown to be positively and significantly related to interest rate spreads. Overall, the results show bank-specific characteristics as the most significant determinants of interest rate spreads compared to industry-specific and macroeconomic factors.

5. Conclusions and Policy Implications

In comparison to regional (EAC and SSA) and international standards, interest rate spreads have persistently remained high in Uganda despite the financial liberalisation that was undertaken in the early 1990s. The high interest rate spreads reflect the high cost of financial intermediation, which undermines the growth of savings, investment, employment, and consequently the country's economic growth. The study used panel data collected from audited commercial banks' financial statements, the BoU, UBOS, and the World Development Indicators for the period 2005-2015 to investigate the determinants of interest rate spreads in Uganda's commercial banking sector.

As far as bank characteristics are concerned, the study finds that an increase in the volume of non-performing loans significantly increases bank spreads. As such, mechanisms that encourage loan repayment should be strengthened. This is currently being spearheaded by the Credit Reference Bureau that was established under the Financial Institutions Act, 2004. However, the Bureau should also consider collecting and sharing information on credit operations of microfinance institutions. More often borrowers obtain multiple loans in microfinance institutions whose data is not captured by the Bureau, which negatively affects loan repayment in commercial banks. In addition, the Bureau should consider using the more authentic National Identification Registrations Authority data to enhance its role of credit information-sharing.

The study has also shown that excess liquidity and high capital adequacy ratios positively influence interest rate spreads. Moreover, Treasury bill rates, contrary to theory, are shown to be negatively related to interest rate spreads; thus, implying that commercial bank lending to the government does not crowd out the private sector. To that effect, banks should be encouraged to offer credit to the public. Probably strengthening of property rights can go a long way in encouraging commercial bank lending since it could reduce credit risks faced by banks, as well as increase the number of creditworthy bank customers. Indeed, given that most of the collateral in Uganda relates to land, a long-term measure to encourage lending among commercial banks would be to increase the registration of land, and strengthen the legal system, particularly the land and commercial divisions to resolve land-related and commercial cases respectively. Still, at the bank level, the size of a bank is shown to be negatively related to interest rate spreads. As such, measures that increase the assets of banks should be encouraged. Such measures could be driven towards increasing deposit mobilisation and enhancing financial inclusion, probably through agency banking.

At a macro-level, the BoU should maintain its stance on curbing inflation given that, among the macroeconomic variables, it is found to lead to higher interest spreads. This is because inflation generally reduces real interest rates. Furthermore, an enhancement of real growth rates of GDP can also go a long way in reducing bank spreads. This could be promoted by the continuous investment in the infrastructure to enhance the economy's productivity, as well as encourage regional integration to widen the market of the country's products. Financial sector development is found to be crucial in reducing interest rate spreads. As such, developments such as mobile money savings and credit facilities, agency banking, bancassurance, and Islamic banking should be encouraged to widen the outreach and scope of banking services. In addition to this, the BoU should restrict the circulation of large denomination notes to encourage the use of banking services among the population. This would in turn increase the resources available to financial institutions to lend to the public, thus reducing interest rate spreads.

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Appendices

Table A1: List of Commercial Banks Included in the Study

1. ABC Capital Bank Ltd.	13. Ecobank Uganda Ltd.
2. Bank of Africa-Uganda Ltd.	14. Equity Bank Uganda Ltd.
3. Bank of Baroda (Uganda) Ltd.	15. Finance Trust Bank Ltd.
4. Bank of India (Uganda) Ltd.	16. Guaranty Trust Bank Uganda Ltd.
5. Barclays Bank of Uganda Ltd.	17. Housing Finance Bank Ltd.
6. Cairo International Bank Ltd.	18. KCB Bank Uganda Ltd.
7. Centenary Rural Development Bank Ltd	19. NC Bank Uganda Ltd.
8. Citibank Uganda Ltd.	20. Orient Bank Ltd.
9. Commercial Bank of Africa (Uganda) Ltd	21. Stanbic Bank Uganda Ltd.
10. Crane Bank Ltd.	22. Standard Chartered Bank Uganda Ltd.
11. DFCU Bank Ltd.	23. Tropical Bank Ltd.
12. Diamond Trust Bank Uganda Ltd.	24. United Bank for Africa (Uganda) Ltd.

Table A2: Data Sources

Variable	Definition	Source
Dependent variable		
Interest rate spread	The difference between interest received divided by total loans and interest paid divided by total deposits for individual commercial bank in a given year	BoU
Explanatory variables		
(A) Bank-specific variables		
Credit risk	The ratio of NPLs to total loans of each bank in each year.	BoU
Liquidity risk	A ratio of liquid assets to deposits of each bank in each year	BoU
Bank size	Logarithm of each bank's total assets in each year	BoU
Operating costs	A ratio of each bank's operating costs to total assets in each year	BoU
Return on assets	Net income divided by average total assets of each bank in each year	BoU
Non-interest income	The ratio of non-interest income to total assets of each bank in each year	BoU
Capital adequacy ratio	Total shareholder's equity divided by risk weighted assets	BoU
(B) Banking industry-specific variables		
HHI	The sum of the square of the market share (loans or deposits) of each bank in each year	BoU
Foreign bank participation	The percentage of foreign bank market share in the loans market in each year	BoU
(C) Macroeconomic variables		
Inflation	The annual change in consumer price index	BoU
Real GDP growth rate	Annual real GDP growth rate	BoU, UBOS, WDI
Treasury bill rate	Annual average 91-day treasury bill rate	BoU
Exchange rate volatility	The standard deviation of the percentage change in the real US$ exchange rate for the preceding three years	BoU
M2/GDP	Annual ratio of M2 to GDP	WDI

Note: BoU is Bank of Uganda, IMF is International Monetary Fund, UBOS is Uganda Bureau of Statistics, WDI is the World Bank World Development Indicator data

Table A3: Panel Unit Root Tests - PP tests

Variable	Fisher type test-PP tests			
	P	Z	L*	Pm
IRS	246.397***	−7.958 ***	−13.248***	20.893 ***
CR	97.037***	−3.498***	−4.104***	5.321***
LR	290.836***	−8.396***	−15.596***	25.526***
BS	87.841***	−3.119***	−3.412***	4.066***
OC	191.623***	−4.962***	−9.236***	14.659***
ROA	90.854***	−3.504***	−4.004***	4.374***
NII	147.073***	−5.178***	−7.307***	10.112***
CAR	156.670***	−3.950***	−7.432***	11.538***
HHI (LOAN)	122.835***	−6.543***	−6.711***	7.638***
HHI (DEPOSIT)	137.555***	−5.590***	−7.221***	9.140***
FOREIGN	99.902***	−5.037***	−4.941***	5.297***
INF	220.723***	−7.692***	−12.515***	17.629***
RGDP	82.021***	−3.489***	−3.770***	3.472***
TBR	44.209	−1.345*	−1.253*	−0.387
ERV	74.183***	−3.645***	−3.476***	2.672***
M2/GDP	220.021***	−10.125***	−12.292***	17.557***

Note: P is the inverse chi-squared statistic; Z is the inverse normal statistic; L* is the inverse logit statistic; and Pm is the modified inverse chi-squared statistic.

***, ** and * indicate significance of the unit root statistics at 1%, 5% and 10% significance levels respectively.

Source: Author's calculations.